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Patent application number
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Patents ADP Number (*if you know it*)

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7419294001

Title of the invention — IMPROVED FINDING OF TV ANYTIME WEB SERVICES

Name of your agent (*if you have one*)
"Address for service" in the United Kingdom to which all correspondence should be sent (*including the postcode*)

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Country	Priority Application number (*if you know it*)	Date of filing (*day/month/year*)
GB	0205977.2	14.03.2002

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DESCRIPTION

IMPROVED FINDING OF TV ANYTIME WEB SERVICES

This invention relates to finding TV Anytime web services using a server based file with a well-known name, location and structure. This invention also relates to a method for aggregating and categorising TV Anytime web services.

The TV Anytime Forum is in the process of standardising a set of web services which allow TV Anytime clients (e.g. PDRs - Personal Digital Recorders) to retrieve TV Anytime data (e.g. program schedules, descriptions, etc.) from TV Anytime IP (Internet Protocol) servers. Different types of TV Anytime web services can be offered from a given web site and can have different, unrelated URLs (Uniform Resource Locators). The object of this invention is to allow a PDR to automatically find out whether an arbitrary web site offers TV Anytime services, and if so which types of services it offers.

1. State of the art

TV Anytime (http://www.tv-anytime.org) has not specified mechanisms for discovering TV Anytime web services. The following work is relevant:

1.1 Use of DNS for finding a TV Anytime service for a particular program identifier

This mechanism is described in the TV Anytime Content Referencing specification (ftp://tva@ftp.bbc.co.uk/pub/Specifications/SP004v11.zip - password "tva"). Given a CRID (Content Reference Identifier), DNS (Domain Name Service) is used to request the machine name and port of a server which is able to provide a TV Anytime service that offers particular information about that CRID. However, once this service has been found it offers no information on the presence or otherwise of other TV Anytime services on the

same server. Moreover, not all TV Anytime service types can be found using this deterministic mechanism. For example, if the PDR wishes to find a server that allows the user to search for programmes, then DNS is not helpful.

1.2 Use of UDDI (Universal Description, Discovery and Integration)

UDDI (http://www.uddi.org) represents one technology for facilitating the discovery of web services. It relies on the use of third-party service repositories that provide a type of web service "Yellow Pages". By querying the repository a device is able to find web services which match a certain technical description and perhaps match some other taxonomy classification. The approach provides a solution to the problem, "How do I find a list of services that provide a certain service type and are TV Anytime compliant?".

1.3 Use of web robots / spiders to index a web site

For traditional static web content (i.e. HTML pages) a web robot can be used to find and index the content of a site. The information gained is stored and used for tools such as search engines. However, this is not well suited for direct use by a PDR (it is a slow process, involving multiple network transactions), nor is it particularly useful when the content is dynamically generated by a web service. Although a method could be conceived whereby a TV Anytime search engine blindly tries to discover services by testing their behaviour, this would be prohibitively slow, error prone and not guaranteed to find all the TV Anytime services provided by that site.

1.4 Use of a robots.txt file (http://www.robotstxt.org/wc/robots.html)

By placing a robots.txt file in a well-known place on a server (e.g. http://foo.com/robots.txt) a server is able to specify a set of rules for the whole web site, which compliant web robots will obey. Whilst not directly relevant to TV Anytime, this is an example of the use of placing a file (with well-known

name, structure and location) on a web server to provide information about the web site that can be used both automatically and manually.

2. The problem

This invention provides a solution to the problem, "How do I know if this web-site offers any TV Anytime services, and if it does where are they?" A solution is needed for two reasons. Firstly, a PDR may be aware of a particular web site (i.e, machine name and port number) as a result of any number of processes (see section 3). It would be useful if the PDR can automatically find whether TV Anytime web services are available. Having established this, the PDR should be able to deduce the types of services offered and where they are offered. Secondly, there is likely to be a market for third party sites that categorise and index the available TVAnytime services (the TV Anytime equivalent of a web directory or search engine). By providing a standardised description mechanism a web tool is able to automatically discover and categorise TV Anytime services without the need for human intervention.

Once the PDR has established the existence of TV Anytime services it needs to find out the following information about each of those services:

- the location where that service is being offered,
- the type of TV Anytime service being offered,
- the technical compliance of that service,
- and the version number of that TV Anytime service.

3. What is proposed

The mechanism proposed is to place a file on the server, which has a standardised structure containing the necessary information. This file has a well-known name and is placed at the entry point to the website, thus allowing a PDR to retrieve the file automatically. The invention specifically includes the use of the WS-Inspection standard to define the file structure and name of the file *(inspection. wsil)*.

The invention assumes that the PDR already has knowledge of a particular web site. The domain name could have been obtained by the following mechanisms:

1. The user has heard of a TV Anytime service through some other medium (e.g. recommendation or advertising) and manually enters the domain name into their PDR.

2. The PDR might support a web browser to allow the user to web surf. It would be relatively inexpensive for a PDR to attempt to download the TV Anytime file (if any) of the web sites visited by the user.

3. The DNS mechanism discussed in section 1.2.

4. A PDR might receive CRIDs from a number of different sources (e.g. embedded in the video stream, as a result of searches, as a result of a program recommendation, or as a result of a remotely generated request to record a program). The authority name can be extracted from CRIDs and used as the domain name in an attempt to find a TV Anytime server file.

In addition, a business model is proposed, whereby third parties can offer search and categorisation services specifically for TV Anytime web servers. This can be viewed as analogous to the search and directory engines (such as Google, Yahoo, etc.) used to discover HTML based web sites. To create such a website, a method for how the third party can automatically aggregate this information is described. A specific use of WS-Inspection specification is proposed that allows third parties to spider between TV Anytime web servers in an efficient fashion.

According to a first aspect of the present invention, there is provided a method for finding TV Anytime web services comprising querying a known address, obtaining a file from said address, said file having a predefined structure, and parsing said file to obtain URLs for TV Anytime web services

According to a second aspect of the present invention, there is provided apparatus for finding TV Anytime web services comprising communicating means for querying via a network a known address and for obtaining a file from said address, said file having a predefined structure, and processing means for parsing said file to obtain URLs for TV Anytime web services.

According to a third aspect of the present invention, there is provided a method for supplying a file via a network comprising receiving a query at a known address, and supplying a file in response to said query, said file having a predetermined structure.

According to a fourth aspect of the present invention, there is provided a server system for supplying a file via a network comprising receiving means for receiving a query at a known address, and supplying means for supplying a file in response to said query, said file having a predetermined structure.

According to a fifth aspect of the present invention, there is provided a method of spidering websites comprising recursively addressing a URL for a non-HTML web service description file, parsing said file to obtain further URLs for non-HTML web service description files, and recording said further URLs.

According to a sixth aspect of the present invention, there is provided a server system for supplying URLs for TV Anytime web services via a network comprising receiving means for receiving a query, supplying means for supplying one or more URLs for TV Anytime web services in response to said query, and storing means for storing a categorised list of TV Anytime web services.

If a web site does offer TV Anytime services it places a file with a well known name at the entry point to that web site. To obtain the file the PDR makes an HTTP GET request to the following URL. *http://<machine name>:<port number>/<well known file name>* The port number is optional and typically would not be included. The exception is case 3 above, where the DNS mechanism will explicitly return a port number as well as a machine name. A machine-readable document (this could be XML but does not have to be) is returned which indicates the presence of TV Anytime services by containing references (URLs) to one or more service description files. This invention does not mandate the type of service description file that should be used, but specifically includes the use of WSDL (Web Services Description Language) and UDDI to provide the four pieces of information listed in section 2. Each service description file may, in turn, provide information on more than one TV Anytime service depending on how the web site chooses to group their

web services. The document may also give the URLs of other related TV Anytime server files to facilitate the discovery and linking together of new services. The mechanism has the following advantages:

- Lightweight and easy for a web site to implement.
- Allows a new TV Anytime web server to describe itself without having to register with a third party.
- Facilitates discovery and indexing mechanisms for use by a web robot in the process of generating a database for a "TV Anytime services search engine".

Although this provides a means by which a web site can identify whether it has TV Anytime services (and if so where they are), this is only useful if the client has prior knowledge of the existence of that web site. In order to find specific TV Anytime services, the only means available to a client device is to conduct an exhaustive search (spidering) of all web sites and to use the mechanism described above to test each one for the existence of TV Anytime services. Such a process is computationally expensive and certainly not feasible for the types of clients envisaged (digital TV receivers, PDAs, etc.).

Therefore it is necessary to alter the searching process to relieve the computational burden placed on the client. This can be achieved by the use of a third party web site containing categorised web services. Since the vast majority of web sites will not offer TV Anytime web services, the searching process is altered to enable spidering of the web in a way that efficiently discovers TV Anytime web servers.

It is proposed that a third party is responsible for conducting the spidering process. There are no restrictions on who this third party might be. Some examples are: a broadcaster wishing to offer a value-adding service for TV Anytime clients; a CE manufacturer wishing to improve the functionality of the equipment they manufacture; and a specialist interest web site wishing to provide TV Anytime information to its users. Since a powerful computer can do the spidering the computational expense is less problematic. The third party

maintains a directory of all the TV Anytime web services it has found. This directory might offer an HTML interface to allow users to find and browse the discovered TV Anytime services. The directory can add value by categorising and grouping the services in certain ways that help the user find the services they want.

In order for the consuming client (i.e. TV Anytime device, such as a digital TV receiver) to be able to automatically retrieve the information from the machine hosting the third party directory, a standard means of describing the list of discovered services is necessary. Such a description could be agreed by some standards body (such as the TV Anytime Forum). Alternatively, if the directory service is hosted by a CE manufacturer, they may choose to implement a private description format since they control both the client implementation (i.e. the CE device) and the directory server.

Another way this invention could be exploited would be for the directory service to offer a single integrated TV Anytime web service, giving access to all the data available from the services that have been discovered. It could then offer the aggregated data through a single TV Anytime web service.

The efficient spidering of TV Anytime services is based upon the mechanism described above of using a structured file (in a well-known location) to describe the TV Anytime services available from that server. Here, it is additionally proposed that this structured file is allowed to contain URLs (i.e. hyperlinks) to the description files on other TV Anytime web servers. In this way, a "web service spider" can be used to recursively find and download the structured file for many TV Anytime web sites.

By spidering across standardised service location files, rather than HTML files, the search space is vastly reduced and the process made more efficient. The structured file is split into two sections - links and descriptions- both of which are optional. A structured file that contains only links can be used to represent a list of TV Anytime web services. This format can itself be used by the directory service as a means of describing all the services it has found.

Some additional restrictions regarding the way the description part of the structured file is formatted can be used to facillitate the process. Specifically, when describing a TV Anytime web service, the structured file should include the following information in its descriptions of the web services available at that site:an indication that the service is a TV Anytime service;the protocol version of the TV Anytime service;the types of TV Anytime services offered. This information must be present in the structured file itself and not by means of reference (e.g. a reference to a detailed description of that service). In this way, there is no need to download and parse other files in order to establish the existence of a TV Anytime service. Consequently, the amount of processing required at each node of the search space is also reduced, once again enabling more effective spidering of TV Anytime web services.

4. Fields of application of the invention

The invention applies to TV Anytime IP clients and servers.

Clients. Any device that wishes to receive information related to TV programme schedules could use this invention. Typically this will be a Personal Digital Recorder or some other TV device (Integrated Digital TV, set-top-box, etc.) that wishes to display TV schedules to a user. However, any other network-enabled devices could also exploit the invention for the same purpose. These include Personal Computers, mobile phones, PDAs, etc.

Servers. Any web server with the appropriate information can host a TV Anytime service. Most often this will be a broadcaster's web server, but also includes third party web sites providing specialised and enhanced metadata about TV programmes.

5. An example of the invention

The Web Services Inspection Language provides one standard method of specifying how to inspect a web site for available Web services. The WSInspection specification defines the locations on a Web site where you

could look for Web service descriptions. The following URLs give an overview and the specification of WS-Inspection:

http://www-106.ibm.com/developerworks/webservices/library/ws-wsilover/

http://www-106.ibm.com/developerworks/webservices/library/ws-wsilspec.html

Figures 1 and 2 show a first embodiment of the invention of placing a file at the entry point of a website, Figure 1 illustrating the format of a possible WS-Inspection file and Figure 2 illustrating the format of the corresponding service description file. Figure 3 shows the steps involved in finding new TV Anytime services, using the files of Figures 1 and 2.

Figure 4 shows a second embodiment with an improved WS-Inspection file. This file structure has two advantages over the WS-Inspection file of Figure 1. Firstly a client device can establish directly from the file the existence of TV Anytime compliant web services without the need for further network transactions. Secondly the links to other TV Anytime WS-Inspection files enable spidering of TV Anytime web services.

http://example.com/inspection.wsil

```
<?xml version="1.0" encoding="UTF-8"?>
<inspection xmlns="http://schemas.xmlsoap.org/ws/2001/10/inspection/"
    xmlns:wsilwsdl="http://schemas.xmlsoap.org/ws/2001/10/inspection/wsdl/">
  <service>
    <description referencedNamespace="http://schemas.xmlsoap.org/wsdl/"
                 location="http://example.com/tva_services.wsdl">
      <wsilwsdl:reference endpoint="true">
        <wsilwsdl:referencedService xmlns:ns="http://example.com/tva">
        ns:TvaCookingService</wsilwsdl:referencedService>
      </wsilwsdl:reference>
    </description>
  </service>
  <service>
    <description referencedNamespace="http://schemas.xmlsoap.org/wsdl/"
                 location="http://example.com/tva_services.wsdl">
      <wsilwsdl:reference endpoint="true">
        <wsilwsdl:referencedService xmlns:ns="http://example.com/tva">
        ns:TvaMovieService</wsilwsdl:referencedService>
      </wsilwsdl:reference>
    </description>
  </service>
  … References to other groups of TV Anytime services could be inserted here

</inspection>
```

Fig. 1

http://example.com/tva_services.wsdl

```
<?xml version="1.0" encoding="UTF-8"?>
<definitions targetNamespace="http://example.com/tva"
    xmlns:tva="http://www.tv-anytime.org/2001/11/transport/wsdl"
    xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
    xmlns="http://schemas.xmlsoap.org/wsdl/">
  <import namespace="http://www.tv-anytime.org/2001/11/transport/wsdl"/>
  <service name="TvaCookingService">
    <port name="get_Metadata_Cooking" binding="tva:get_Resolution_Port">
      <soap:address location="http://example.com/cooking"/>
    </port>
    <port name="searchOn_Delivery_Cooking"
          binding="tva:searchOn_Delivery_Port">
      <soap:address location="http://example.com/cooking"/>
    </port>
  </service>
  <service name="TvaMovieService">
    <port name="get_Metadata_Movies" binding="tva:get_Metadata_Port">
      <soap:address location="http://example.com/movies"/>
    </port>
    <port name="searchOn_Description_Movies"
          binding="tva:searchOn_Description_Port">
      <soap:address location="http://example.com/movies"/>
    </port>
  </service>
</definitions>
```

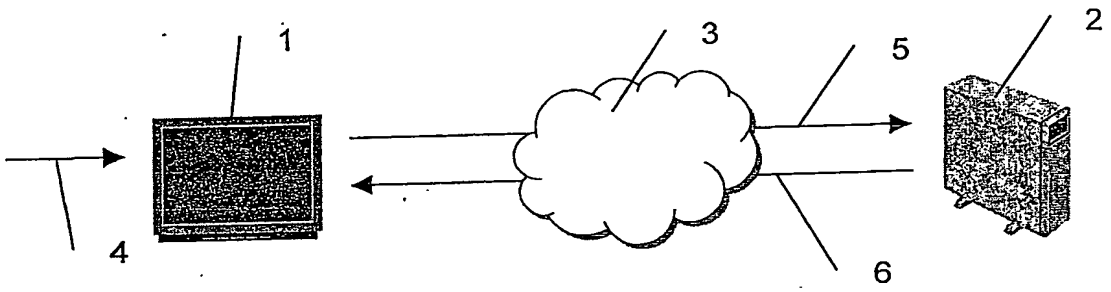
The namespace indicates compliance with TVA, along with the version

The port name gives the type of TVA services supported

The entry points (URL) to the different constituent services

Fig 2

The steps involved in finding new TV Anytime services.



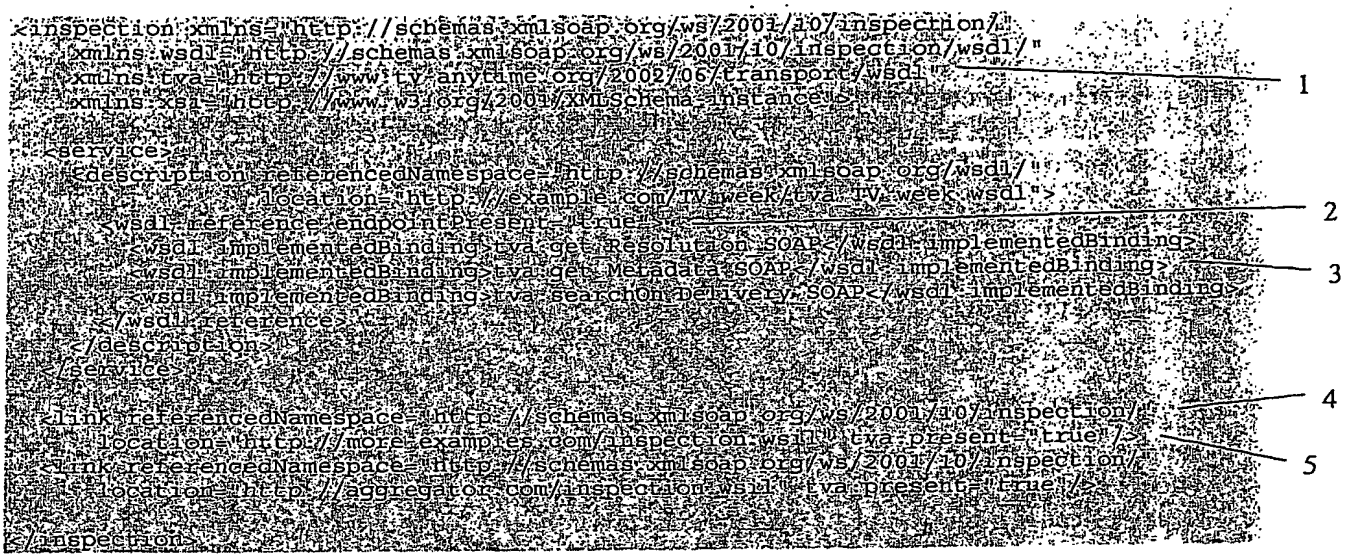
1. Network enabled TV Anytime device (such as an integrated digital TV).
2. Remote network web server, possibly offering TV Anytime compliant web service (such as schedule listings, movie information, etc.).
3. A wide area network (such as the Internet).
4. A web server host name obtained by some means (such as those given in section 3).
5. A structured query from 1 to 2 (such as a SOAP request or an HTTP request).
6. A structured response from 2 to 1 (such as a SOAP request or an HTTP request).

To successfully find a TV Anytime web service the following sequence of requests (5) and responses (6) must occur.

A. First, device 1 obtains a host name 4 (such as example.com).
B. Device 1 makes an HTTP GET request to the server 2 for the well-known file (e.g. http://example.com/inspection.wsil).
C. If the server 2 offers web services (not necessarily TV Anytime ones) it will return a successful HTTP response containing the requested file (inspection.wsil). If the server 2 offers no web services it will send back an HTTP 404 (file not found) response and the search process will terminate.
D. Device 1 parses the file and establishes the endpoints of the service descriptions (such as the URL of a WSDL file describing how to use the services). All subsequent steps will be repeated for each of the end points found.
E. Device 1 tries to obtain the service description for that endpoint. The exact mechanism for doing this depends on the service description protocol being used (such as UDDI or WSDL). In this case we will assume that WSDL is being used. To obtain the WSDL file, device 1 makes an HTTP GET request to the server 2 for the file (e.g. http://example.com/tva_services.wsdl).
F. Device 1 parses the returned file and establishes if any of the described services are TV Anytime compliant services. This is determined by the XML namespace given to the services. If none of the endpoints offer TV Anytime services the search process will terminate. The file also allows device 1 to determine the precise technical version of each service as well as the URL where the service is offered. Device 1 now has all the information required to use the TV Anytime web service.
G. At this stage device 1 may choose to cache the information on the TV Anytime services offered by that server, or to make use of those services immediately.

Fig 3

http://example.com/inspection.wsil



1. The TV Anytime namespace, which indicates the version of the protocol being referenced.
2. The *endpointPresent* attribute indicates that the TV Anytime service is actually available.
3. When qualified by the namespace prefix ("*tva*:"), the *implementedBinding* elements indicate the types of TV Anytime services available.
4. This is a link indicating the presence of a URL offering a structured file of the same format as this one.
5. The *present* attribute indicates that at least one TV Anytime service is referenced in the document that is being linked to.

Items 1 - 3 indicate how to use the WS-Inspection *description* elements to reference TV Anytime services. The use of *implementedBinding* elements means that the spidering robots does not need to download a WSDL file (as given in the *location* attribute) to establish the presence of TV Anytime service.

Items 4 - 5 indicate how links to other WS-Inspection documents are shown. By following these links other WS-Inspection documents containing references to TV Anytime services will be found.

Fig 4